CLAIMS

1. (Amended) An article with an organic-inorganic composite film, the article comprising a substrate and an organic-inorganic composite film that is formed on a surface of the substrate and contains an organic material and an inorganic oxide,

wherein the organic-inorganic composite film contains a hydrophilic organic polymer as the organic material,

the organic-inorganic composite film contains silica as the inorganic oxide,

the organic-inorganic composite film contains the silica as its main component, and

the organic-inorganic composite film does not separate from the substrate after the Taber abrasion test prescribed in Japanese Industrial Standards R 3212 that is carried out with respect to a surface of the organic-inorganic composite film.

2. The article according to claim 1, wherein the organic-inorganic composite film has a thickness of more than 250 nm but not more than 5 μm.

3. The article according to claim 2, wherein the organic-inorganic composite film has a thickness of more than 300 nm but not more than 5 μm.

4. The article according to claim 3, wherein the organic-inorganic composite film has a thickness of 1 μm to 5 μm.

5. The article according to claim 1, wherein a portion that has been subjected to the Taber abrasion test has a haze ratio of 4% or lower after the Taber abrasion test.

6. The article according to claim 1, wherein the content of the organic material in the organic-inorganic composite film is 0.1 to 60% with respect to the total mass of the organic-inorganic composite film.

7. The article according to claim 1, wherein the organic-inorganic composite film contains phosphorus.

8. (Cancelled)

9. (Amended) The article according to claim 1, wherein the hydrophilic organic polymer includes a polyoxyalkylene group.

10. The article according to claim 1, wherein the organic-inorganic composite film contains fine particles.

11. The article according to claim 10, wherein the content of the fine particles is at least 1 mass%, and a portion that has been subjected to the Taber abrasion test has a haze ratio of 4% or lower after the Taber abrasion test.

12. A process for producing an article with an organic-inorganic composite film, the article including a substrate and an organic-inorganic composite film that is formed on a surface of the substrate and contains an organic material and an inorganic oxide, the organic-inorganic composite film containing silica as the inorganic oxide, and the organic-inorganic composite film containing the silica as its main component,

the process comprising:

applying a film-forming solution for forming the organic-inorganic composite film to the surface of the substrate; and

removing at least a part of a fluid component contained in the

film-forming solution from the film-forming solution that has been applied to the substrate,

wherein the film-forming solution contains silicon alkoxide, strong acid, water, and alcohol,

the film-forming solution further contains a hydrophilic organic polymer to be at least a part of the organic material, as at least a part of the strong acid or as a component other than the strong acid,

the silicon alkoxide has a concentration exceeding 3 mass% in terms of a SiO_2 concentration when silicon atoms contained in the silicon alkoxide are expressed as SiO_2,

a) in the case where the film-forming solution contains a phosphorus source, the strong acid has a concentration in a range of 0.0001 to 0.2 mol/kg in terms of the molality of protons that is obtained assuming that the protons have dissociated completely from the strong acid,

b) in the case where the film-forming solution contains no phosphorus source, the strong acid has a concentration in a range of 0.001 to 0.2 mol/kg in terms of the molality of protons that is obtained assuming that the protons have dissociated completely from the strong acid, and the silicon alkoxide has a concentration of lower than 13 mass% in terms of the SiO_2 concentration,

the number of moles of the water is at least four times the total number of moles of the silicon atoms contained in the silicon alkoxide, and

at least a part of the fluid component contained in the film-forming solution that has been applied to the substrate is removed, with the substrate being maintained at a temperature of 400°C or lower.

13. The process for producing an article according to claim 12, wherein the concentration of the hydrophilic organic polymer is:

c) 30 mass% or lower with respect to the SiO_2, in the case where the silicon alkoxide has a concentration of 9 mass% or lower in terms of the SiO_2 concentration, and

d) $(5A - 15)$ mass% or lower where A denotes the SiO_2 concentration, in the case where the silicon alkoxide has a concentration exceeding 9 mass% in terms of the SiO_2 concentration.

14. The process for producing an article according to claim 12, wherein the silicon alkoxide contains at least one selected from tetraalkoxysilane and a material made by polymerization of tetraalkoxysilane.

15. The process for producing an article according to claim 12, wherein the silicon alkoxide has a concentration of 30 mass% or lower in terms of the SiO_2 concentration.

16. The process for producing an article according to claim 12, wherein at least a part of the phosphorus source is phosphoric acid that is contained as at least a part of the strong acid.

17. The process for producing an article according to claim 12, wherein at least a part of the phosphorus source is a phosphoester group that is contained in the hydrophilic organic polymer.

18. The process for producing an article according to claim 12, wherein the hydrophilic organic polymer contains a polyoxyalkylene group.

19. The process for producing an article according to claim 12, wherein the number of moles of the water is 5 to 20 times the total number of moles of the silicon atoms that are contained in the silicon alkoxide.

20. The process for producing an article according to claim 12, wherein the film-forming solution further contains fine particles.

21. The process for producing an article according to claim 12, wherein the organic-inorganic composite film with a thickness of more than 250 nm but not more than 5 μm is formed by carrying out each of the following processes once: a process of applying the film-forming solution; and a process of removing at least a part of the fluid component contained in the film-forming solution that has been applied.

22. (Added) The article according to claim 1, wherein the substrate is a glass sheet.

23. (Added) The process for producing an article according to claim 12, wherein the substrate is a glass sheet.

24. (Added) The process for producing an article according to claim 12, wherein the organic-inorganic composite film does not separate from the substrate after the Taber abrasion test prescribed in Japanese Industrial Standards R 3212 that is carried out with respect to a surface of the organic-inorganic composite film.

25. (Added) An article with an organic-inorganic composite film, the article comprising a substrate and an organic-inorganic composite film that is formed on a surface of the substrate and contains an organic material and an inorganic oxide,

wherein the organic-inorganic composite film contains silica as the inorganic oxide,

the organic-inorganic composite film contains the silica as its main component,

the organic-inorganic composite film contains no fine particles,

the substrate is a glass sheet, and

the organic-inorganic composite film does not separate from the

substrate after the Taber abrasion test prescribed in Japanese Industrial Standards R 3212 that is carried out with respect to a surface of the organic-inorganic composite film.

26. (Added) A process for producing an article with an organic-inorganic composite film, the article including a substrate and an organic-inorganic composite film that is formed on a surface of the substrate and contains an organic material and an inorganic oxide, the organic-inorganic composite film containing silica as the inorganic oxide, the organic-inorganic composite film containing the silica as its main component, the organic-inorganic composite film containing no fine particles, and the substrate being a glass sheet,

the process comprising:

applying a film-forming solution for forming the organic-inorganic composite film to the surface of the substrate; and

removing at least a part of a fluid component contained in the film-forming solution from the film-forming solution that has been applied to the substrate,

wherein the film-forming solution contains silicon alkoxide, strong acid, water, and alcohol,

the film-forming solution further contains a hydrophilic organic polymer that is at least a part of the organic material, as at least a part of the strong acid or as a component other than the strong acid,

the silicon alkoxide has a concentration exceeding 3 mass% in terms of a SiO_2 concentration when silicon atoms contained in the silicon alkoxide are expressed as SiO_2,

a) in the case where the film-forming solution contains a phosphorus source, the strong acid has a concentration in a range of 0.0001 to 0.2 mol/kg in terms of the molality of protons that is obtained assuming that the protons have dissociated completely from the strong acid,

b) in the case where the film-forming solution contains no phosphorus

source, the strong acid has a concentration in a range of 0.001 to 0.2 mol/kg in terms of the molality of protons that is obtained assuming that the protons have dissociated completely from the strong acid, and the silicon alkoxide has a concentration of lower than 13 mass% in terms of the SiO_2 concentration,

the number of moles of the water is at least four times the total number of moles of the silicon atoms contained in the silicon alkoxide, and

at least a part of the fluid component contained in the film-forming solution that has been applied to the substrate is removed, with the substrate being maintained at a temperature of 400°C or lower.

27. (Added) An article with an organic-inorganic composite film, the article comprising a substrate and an organic-inorganic composite film that is formed on a surface of the substrate and contains an organic material and an inorganic oxide,

wherein the organic-inorganic composite film contains silica as the inorganic oxide,

the organic-inorganic composite film contains the silica as its main component,

the organic-inorganic composite film contains fine particles of conductive oxide, and

the organic-inorganic composite film does not separate from the substrate after the Taber abrasion test prescribed in Japanese Industrial Standards R 3212 that is carried out with respect to a surface of the organic-inorganic composite film.

28. (Added) A process for producing an article with an organic-inorganic composite film, the article including a substrate and an organic-inorganic composite film that is formed on a surface of the substrate and contains an organic material and an inorganic oxide, the organic-inorganic composite film containing silica as the inorganic oxide, the organic-inorganic composite film

containing the silica as its main component, and the organic-inorganic composite film containing fine particles of conductive oxide,

the process comprising:

applying a film-forming solution for forming the organic-inorganic composite film to the surface of the substrate; and

removing at least a part of a fluid component contained in the film-forming solution from the film-forming solution that has been applied to the substrate,

wherein the film-forming solution contains silicon alkoxide, strong acid, water, alcohol, and the fine particles of conductive oxide,

the film-forming solution further contains a hydrophilic organic polymer that is at least a part of the organic material, as at least a part of the strong acid or as a component other than the strong acid,

the silicon alkoxide has a concentration exceeding 3 mass% in terms of a SiO_2 concentration when silicon atoms contained in the silicon alkoxide are expressed as SiO_2,

a) in the case where the film-forming solution contains a phosphorus source, the strong acid has a concentration in a range of 0.0001 to 0.2 mol/kg in terms of the molality of protons that is obtained assuming that the protons have dissociated completely from the strong acid,

b) in the case where the film-forming solution contains no phosphorus source, the strong acid has a concentration in a range of 0.001 to 0.2 mol/kg in terms of the molality of protons that is obtained assuming that the protons have dissociated completely from the strong acid, and the silicon alkoxide has a concentration of lower than 13 mass% in terms of the SiO_2 concentration,

the number of moles of the water is at least four times the total number of moles of the silicon atoms contained in the silicon alkoxide, and

at least a part of the fluid component contained in the film-forming solution that has been applied to the substrate is removed, with the substrate being maintained at a temperature of 400°C or lower.